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ENGINEERING AND EQUIPMENT

No. 77



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UDC 621.039.54;539.3

INVESTIGATING THE ANISOTROPY OF THE THERMAL EXPANSION COEFFICIENT OF FUEL ELEMENT CLADDING MADE OF ZIRCONIUM-1 PERCENT NIOBIUM ALLOY

Moscow ATOMNAYA ENERGIYA in Russian Vol 50, No 3, Mar 81 pp 207-209
manuscript received 22 Jan 80

SOLYANYI, V. I., BUTRA, F. P., KONEV, V. N., LYSENKO, A. I. and YAMNIKOV, V. S.

[Abstract] The anisotropy of the thermal expansion coefficient was investigated in fuel element cladding made of zirconium-1 percent niobium alloy. X-ray diffraction analysis was used to determine the grain orientation of the fuel element cladding in VVER and RBMK type reactors. Thermoelastic stresses were calculated in anisotropic cylindrical fuel cladding. It is assumed that the anisotropy of the constants of elasticity is insignificant compared to that of the thermal expansion coefficient, the constants of the material are weakly dependent on temperature and the temperature differential through the cross section of the material is insignificant compared to the mean absolute cross-sectional temperature. Thermoelastic stresses significantly affect the cladding of VVER-1000 and RBMK-1500 fuel elements. Figures 4, references 4: 2 Russian, 1 Czech, 1 Western.

[108-6521]

UDC 621.039:620.193.01

STATE OF METAL SURFACES OF NUCLEAR POWER PLANT SYSTEMS WITH RBMK-1000 REACTORS AFTER INSTALLATION

Moscow ATOMNAYA ENERGIYA in Russian Vol 50, No 3, Mar 81 pp 181-183
manuscript received 29 May 80

SEDOV, V. M., KRUTIKOV, P. G., GRUSHANIN, A. I., ZOLOTUKHIN, S. T., ZAKHARZHEVSKIY, Yu. O. and YEGERIN, A. P.

[Abstract] The state of the surfaces of some production systems of the third block of the Leningrad Nuclear Power Plant was studied during the final state of installation. A list of the main systems of the block is given with indication

of the approximate amount of construction materials used. Visual inspection of the internal surfaces of austenitic steel equipment during installation revealed that these surfaces contain no iron oxides formed during storage and installation and contamination consists mainly of dust, spatters of mud and welding scale. The inner surfaces of the piping of the condensate-feed channel and the main steam pipelines made of steel 20 showed that the surface was coated with a layer of reddish brown corrosion products and thermal scale. The total amount of corrosion on the surface of perlite steel was calculated at 100-170 g/m². It is recommended that a special chemical technique be used to reduce the corrosive activity in perlite steels. Equipment made of austenitic steels and MNZh alloys requires only hydraulic cleaning of mechanical contaminants. Figures 2, references 3 Russian.

[108-6521]

UDC 621.039.51:621.039.519

MEASURING SPECTRAL INDICES IN UNIFORM RBMK TYPE ARRAYS AT DIFFERENT CHANNEL-GRAPHITE TEMPERATURE GRADIENTS

Moscow ATOMNAYA ENERGIYA in Russian Vol 50, No 3, Mar 81 pp 176-181
manuscript received 6 Aug 79

KAMANIN, P. M., YEGIAZAROV, M. B., ROMANENKO, V. S., FEYNBERG, O. S. and KIMYZOV, V. V.

[Abstract] Experiments on homogeneous arrays of RBMK type mockup cartridges with uranium dioxide with and without water in the channels were carried out at different channel-graphite temperature gradients. Random experimental errors were calculated as mean square errors for a series of independent equally precise measurements. The slow neutron spectrum becomes increasingly harder due to the decrease of the mean moderating capability in the cell. The slow neutron spectrum becomes harder due to fuel enrichment from 0.7 to 2.0 percent in both the graphite and in the channel. Neutron temperature and spectral indices sensitive to temperature variation increased upon heating of the entire assembly and of individual zones of the cell. The most important spectral index for plutonium and uranium is determined by the VRM program. Both the VRM and the THERMOS programs can be used to calculate the spectral indices of thermal neutrons in RBMK type arrays. Figures 7, references 6: 4 Russian, 2 Western.

[108-6521]

DATA-PROCESSING CONTROL SYSTEMS OF ANGARA-5 THERMONUCLEAR INSTALLATIONS: CONSTRUCTION DIAGRAMS, CHARACTERISTICS AND OPERATION

Moscow ATOMNAYA ENERGIYA in Russian Vol 50, No 3, Mar 81 pp 171-175
manuscript received 23 Jun 80

ZAYTSEV, V. I., KRASHENINNIKOV, I. S., KUROCHKIN, S. S., MATVEYEV, V. V. and
SMIRNOV, V. P.

[Abstract] Data processing control systems were developed to automate the process of recording and processing of large information flows, to synchronize the operation of individual assemblies and to develop recommendations on the operating modes of Angara-5 thermonuclear installations. The multilevel hierarchical structure of the systems that include self-contained devices, local data processing systems, supervisor information systems and large computers was used in the approach. The different levels of the Angara-5 installations are described with respect to the structure and characteristics of the data processing control systems and software. The programs for the software are usually written in FORTRAN or BASIC languages. The operating, adjusting and monitoring systems of the programs are generated as a function of operating mode. The processing information is documented on digital printers. Figures 2, references 14:
3 Russian, 9 Western.
[108-6521]

UDC 621.039.58

DYNAMICS OF STARTUP MODES OF NUCLEAR POWER PLANTS WITH FAST REACTOR AND DISSOCIATING COOLANT

Minsk IZVESTIYA AKADEMII NAUK BSSR: SERIYA FIZIKO-ENERGETICHESKIKH NAUK in Russian
No 4, Oct-Dec 80 pp 9-14 manuscript received 24 Dec 79

SKURAT, V. V. and SHAROVAROV, G. A., Institute of Nuclear Power Engineering,
BSSR Academy of Sciences

[Abstract] The results of investigating transient and quasi-steady processes in reactor equipment were used to calculate the temperature fields as boundary-value conditions with regard to startup conditions at nuclear power plants. A fast-neutron reactor with supercritical coolant parameters was used at the plant. The time constants of nuclear power plant equipment were analyzed as a function of transient processes in the equipment, quasi-steady processes in the equipment and coolant and transient heat transfer in thick-walled components of equipment. Reactor power varies nonlinearly during warmup at constant pressures and flow rate and with linear variation of temperature at the output. A fast reactor with dissociating coolant is self-regulating due to the effect of fuel

temperature and coolant density variation on reactivity. The influence of kinetics of the chemical reaction on heat transfer and properties can be disregarded at supercritical coolant pressure. Figures 4, references 10 Russian. [112-6521]

UDC 621.315.2

USE OF HEAT RESISTANT CABLES WITH MINERAL INSULATION IN NUCLEAR POWER ENGINEERING

Moscow IZVESTIYA AKADEMII NAUK SSSR: ENERGETIKA I TRANSPORT in Russian No 1, Jan-Feb 81 pp 121-133 manuscript received 2 Jun 80

YEMEL'YANOV, I. Ya., VOLOD'KO, Yu. I. and YEFANOV, A. I., Moscow

[Abstract] Heat and radiation resistant cables with mineral insulation are being employed more and more often to transmit signals from intrareactor sensors within the core and biological shield; and they may often be used to provide electrical power supply to intrareactor equipment. These cables are manufactured exclusively from metals and powdered oxides and are insulated with stainless-steel and Inconel. Two industrial processes are used to produce the cables: drawing and roll forging. An important factor in obtaining cable with high insulation resistance is the hermetic sealing of the ends of the insulation, which may be achieved by using various types of sealing devices or tips which are compatible with ceramics or glass in terms of the linearity of their thermal expansion. The use of cables with mineral insulation does not require changes in the design of nuclear electric plants or supplementary expenditures for construction: it offers a more reliable and less expensive alternative to organically-insulated cables. Figures 4, references 25: 9 Russian, 16 Western. [90-8617]

NON-NUCLEAR ENERGY

ADJUSTMENT OF REGENERATIVE UNITS OF K-500-65/3000 TURBINES IN 1000 MW GENERATING FACILITY

Moscow ENERGETIK in Russian No 11, Nov 80 p 13

[Article by engineers A. V. Kaban, B. I. Marushak, S. A. Trifonova, I. P. Aleksandrov and I. V. Yurchishin]

[Text] The regenerative unit of the K-500-65/3000 turbine in a 1000 MW generating facility includes five low-pressure heaters (LPH), the first heating stage being made up of two separate heaters (LPH-1A and LPH-1B) connected in parallel with respect to the main condensate and the condensate of the heating steam. The two heaters are territorially separated: LPH-1A is situated near the first and second low-pressure cylinders, and LPH-1B is located near the third and fourth low-pressure cylinders. All the low-pressure heaters had been equipped with drainage coolers for the heating steam, but the coolers of heaters No 2-5 were disconnected because of unreliable operation.

Drainage discharge of the heating steam from the low-pressure heaters is in a cascade arrangement to the turbine condenser through the drainage cooler of LPH-1.

The system for removing uncondensed gases (detonating mixture) to the condenser is made in a parallel arrangement (Fig. 1). The lines for suction of the detonating mixture from LPH-3-LPH-5 (50 mm in diameter) and from LPH-2 (80 mm in diameter) were combined into a common collector 100 mm in diameter leading to the fourth condenser. The line for suction of the detonating mixture from LPH-1B (80 mm in diameter) is connected to the same condenser. A receiver for the detonating mixture is located inside the condenser near the point of connection of the 100 mm collector and the 80 mm line from LPH-1B. The suction line from LPH-1A is connected to the second condenser.

With turbine No 1 operating under a load close to nominal, a check was made on the way that operation of LPH-2 and LPH-1B is influenced by suction of the detonating mixture from the other heaters. It was found that closing the valves on the suction lines from LPH-4 and LPH-5 raises the temperature of the main condensate following LPH-2 and LPH-1B, i.e. in the designed arrangement for removing the detonating mixture from LPH-2 and LPH-1B, their suction lines were overwhelmed by the suction from the other heaters, disrupting their operation.

In the adjustment period, the system for removing detonating mixture from LPH-2 was updated (Fig. 2). The 80 mm suction line from LPH-2 was disconnected from

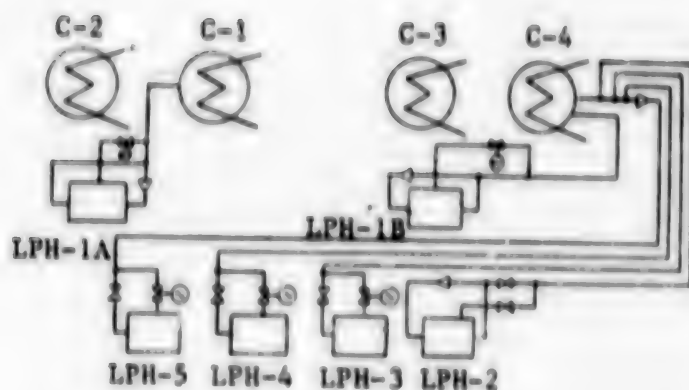
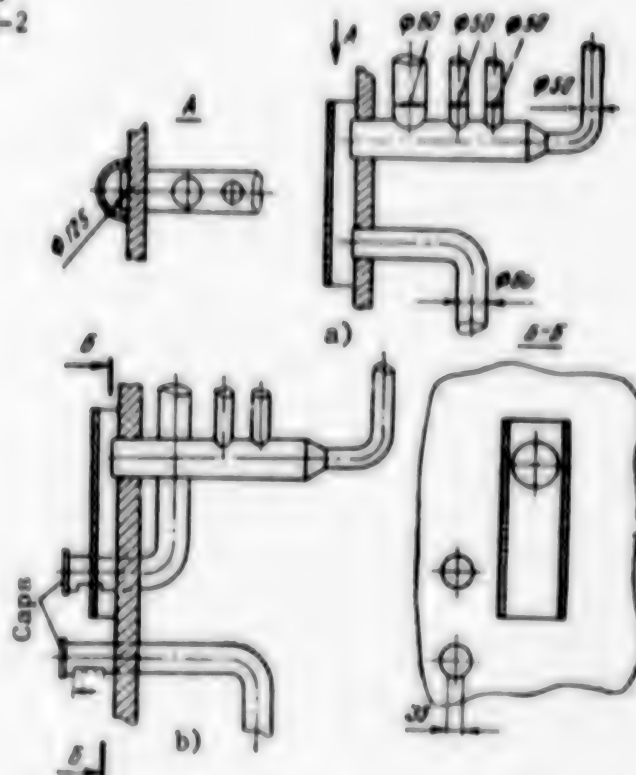


Fig. 1. Design arrangement of lines for suction of steam-gas mixture from the low-pressure heaters to the turbine condensers

Fig. 2. Modification of the arrangement for input of the steam-gas suction lines from the low-pressure heaters to the condenser: a--before improvement; b--after improvement



the common 100 mm collector and connected to the condenser beyond the limits of the receiver. The point of connection of the 90 mm detonating mixture line from LPH-1B was also removed beyond the range of the receiver. To prevent the stream of fluid from these lines from hitting the condenser tubes directly, they were capped on the end, and a slot was made on their cylindrical surface with dimensions of 35 x 70 mm for discharge of the mixture.

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UDC 621.472

ENGINEERING DESIGN OF SPHERICAL FACETS FOR APPROXIMATING A PARABOLOIDAL SURFACE

Tashkent GELIOTEKHNIKA in Russian No 4, Jul-Aug 80 pp 72-73 manuscript received 8 Jan 80

VAYNER, A. A. and SHEYNINA, A. G., Central Design Engineering Office for Scientific Instruments, USSR Academy of Sciences

[Abstract] For a first-order approximation of a paraboloidal surface with spherical facets, expressions have been derived for the deviation (both sagittal and meridional) of a normal to such a facet from the normal to the ideal surface. The optimum radius of curvature of a circular (in the plane view) facet has also been calculated. Here the results, including the maximum estimated error, are presented in tabular and graphical form convenient for engineering design and applicable also to nearly square (in the plan view) spherical facets. Figures 2, table 1, references 2 Russian.
[113-2413]

UDC 662.997

PRELIMINARY RESULTS OF AN EXPERIMENTAL STUDY OF A SOLAR AIR HEATER IN YAKUT ASSR

Tashkent GELIOTEKHNIKA in Russian No 4, Jul-Aug 80 pp 46-49 manuscript received 10 Apr 79

KIM, V. P. and SKUBA, V. M., Institute of Physicotechnical Problems of Northern Regions

[Abstract] A solar air heater for mining shafts and pits in the permafrost regions was built in 1978 at the Physicotechnical Institute of the USSR Academy of Sciences and then tested in Yakutsk. Atmospheric air is sucked by a "Saturnas" fan through a 0.01 m² square connecting tube into a 2170 x 462 x 100 mm wooden box with a 2170 x 462 mm glass cover and a spread out corrugated perforated metal strip inside acting as the heater. Preliminary measurements indicate that this heater performs satisfactorily at any ambient temperature, even below -30° C, producing a temperature rise which varies from 10 to 40° C over the year.

Only 8-10 h daily are available in this region in summer. The results of measurements, taking into account diurnal and seasonal variations, yield an efficiency of approximately 55% for calculation of the rate of heat delivery in this region according to conventional engineering formulas. Figures 3, references 1 Russian, [115-2415]

UDC 621.472.004

GEOMETRY OF THE HELIOSTAT FIELD IN A TOWER-TYPE SOLAR POWER PLANT

Tashkent GELIOTEKHNIKA in Russian No 4, Jul-Aug 80 pp 33-42 manuscript received 8 Jan 80

TEPLYAKOV, D. I. and APARISI, R. R., State Scientific Research Institute of Power Engineering imeni G. M. Khrushchevskiy

[Abstract] The geometrical configuration of the concentrator in a tower-type solar power plant is changed continuously, as the position of the sun along the sky changes, so that theoretically all rays reflected by each heliostat cell will enter the receiver. An analysis of the heliostat kinematics can be based on direct calculations of the angular coordinates at successive instants of time, or on the "field" concept. Here the latter method of analysis is considered and, accordingly, the geometrical utilization factors are calculated for the mirror surfaces of heliostats. These calculations involve a rotating system of coordinates, in which the field of azimuth angles β' (referred to the azimuth of the sun at any given instant of time) and the field of elevation angles z are determined, where the $\beta' = \text{const}$ lines are found to be hyperbolas and the $z = \text{const}$ curves are found to degenerate into a circle as the sun approaches the zenith. The field method of analysis has applications in both research and engineering. Practical examples are the design of a 270 m tall tower with a central-square layout of heliostats ensuring a circular irradiation of the receiver in a 200 MW solar power plant (located at 45° north latitude) and a 44.5 m tall tower with a northern-sectoral layout of heliostats in a 5 MW solar power plant (Albuquerque, N.M.). Figures 4, references 6: 4 Russian, 2 Western, [115-2415]

SIMULATION FOR THE DESIGN OF MIRROR-TYPE CONCENTRATOR ARRAYS IN SOLAR HEAT PLANTS

Tashkent GELIOTEKHNIKA in Russian No 4, Jul-Aug 80 pp 27-32 manuscript received 23 Jan 80

ZAKHIDOV, R. A., Central Design Engineering Office for Scientific Instruments, USSR Academy of Sciences

[Abstract] Concentrator mirrors are used for increasing the radiation flux density in solar heat plants and for raising the temperature to levels at which thermoelectric converters perform most efficiently. Modern concentrators consist of an unwieldy number of components, typically up to 400,000 mirror cells and 15,000 heliostats with drives in a 10 MW tower. The design and optimization of such devices requires special methods, the simulation process being an important ingredient here. The first step is selection of the appropriate "efficiency criterion", it can be maximizing the efficiency at a given cost or minimizing the cost of maintaining a given efficiency. The last step is construction, testing and evaluation of prototypes. Models are generally classified into ideal (conceptual, symbolic) and material (geometrical, physical, mathematical) ones or into substantial, structural, and functional ones. There are, furthermore, pure and hybrid models. Each type offers certain advantages in the specific application and should be considered in a correct and thorough planning of the simulation with attendant experiments. Figure 1, references 10 Russian, [115-2415]

UDC 662.997

INCREASING THE EFFICIENCY OF A SOLAR ENERGY-TO-HEAT CONVERTER BUILT WITH VACUUMIZED TUBULAR GLASS CELLS

Tashkent GELIOTEKHNIKA in Russian No 4, Jul-Aug 80 pp 3-4 manuscript received 8 Jan 80

KOLTUN, M. M., NEVEZHIN, O. A., ROMANKEVICH, A. V. and YURIN, Ye. M., "Order of Labor's Red Banner" All-Union Scientific Research Institute of Current Sources

[Abstract] In a continuing effort to improve the design of tubular-type solar energy-to-heat converters, a water heater has been built which consists of 40 glass cells connected in series and laid on a corrugated foil with a total surface area of 1 m². Each cell is a 0.5 m long coaxial pair of tubes, the outer one 40 mm in diameter and the inner one with a coating of a high-grade selective material ($\alpha/\epsilon = 19$) 32 mm in diameter. Special attention was paid to minimizing the heat losses, by adequate insulation of the fasteners joining the cells pairwise. The device was tested in Jun 1979 in the Gelendzhik district without sun tracking. With a water rate of 8 and 10 liters per hour before noon (10 h) and after noon (14 h), respectively, the efficiency of this converter was found to be correspondingly 82 and 78%. Figures 2, references 3: 2 Russian, 1 Western, [115-2415]

INVESTIGATION OF AIRCRAFT INDUCTION MOTORS WITH UNSTABLE POWER SUPPLY FREQUENCY

Moscow IZVESTIYA AKADEMII NAUK SSSR: ENERGETIKA I TRANSPORT in Russian No 1,
Jan-Feb 81 pp 42-51 manuscript received 6 Aug 79 after revision 4 Jun 80

AVETISYAN, D. A., YERMILOV, M. A., MALYUTIN, A. A. and KOLYADA, V. K., Moscow

[Abstract] Many Soviet and foreign passenger aircraft employ stable-frequency alternating current electrical power supplies with constant-rpm drive. Variable frequency power supplies are proposed which are driven from the aviation reducing gear; they are simple to design, have higher efficiency and are more economical. The possible use of three-phase squirrel-cage induction motors is considered: voltage is stabilized but frequency varies widely. Alteration of the rate of rotation of aviation fuel pump induction motors in proportion to the power supply affords additional opportunities for control, reduces hydraulic losses in jet pumps, and ensures the necessary fuel flow rate into the power plant. Series manufactured induction motors cannot be widely varied in operating frequency, so new motors should be designed which meet the technical requirements of effective standards for all frequencies of power supply systems. Tables 3, figures 3, references 10 Russian.

[90-8617]

ENSURING THE PROPER OPERATING CONDITIONS FOR A SERVO MECHANISM COUPLED TO A LOW-SPEED ELECTRIC MOTOR

Vilnius VIBROTEKHNIKA in Russian No 3(27), 1979 pp 59-64 manuscript received 8 Sep 75

YORUSHAS, Rem. A., KENSTAVICHENE, G. K. and RONDOMANSKAS, M. S., Kaunas Polytechnic Institute imeni A. Sniechkus

(Abstract) There is an increasing demand for low-speed electric motors, with electromagnetic speed reduction, to drive various precision instruments. Such motors must meet stringent performance requirements, particularly with regard to torsional rotor vibration and length of the transient starting period. In an experimental study of this problem a 60 rpm motor (rotor with a fixed moment of inertia $3 \text{ g}\cdot\text{cm}\cdot\text{s}^2$) was coupled to a servomechanism of the tape transport type (rotor with a variable moment of inertia $7-65 \text{ g}\cdot\text{cm}\cdot\text{s}^2$), the system also including an elastic sleeve coupling and a viscous damper. The object of the experiment was to optimally match the coupling and the damper with the moment of inertia of the servomechanism so as to ensure a vibration amplitude not larger than $20-30'$ and a starting time (pull into synchronism) not longer than 0.5 s . The coupling could be selected from among five different ones with torsional stiffness ranging from $1.7\cdot 10^5$ to $15.4\cdot 10^5 \text{ g}\cdot\text{cm}/\text{rad}$. The damper consisted of a silicon jacket (moment of inertia $9.4 \text{ g}\cdot\text{cm}\cdot\text{s}^2$) coupled to the shaft and a flywheel (moment of inertia $2-9.85 \text{ g}\cdot\text{cm}\cdot\text{s}^2$) free to rotate relative to the shaft (0.2 mm clearance between jacket and flywheel), this flywheel being a stack of disks either left loose or rigidly fastened together. The best results were obtained by installing the coupling with a torsional stiffness of $2.1\cdot 10^5 \text{ g}\cdot\text{cm}/\text{rad}$ and the flywheel with loose disks, this combination reducing the vibration amplitude to $12'$ and the starting time to 0.35 s . Figures 4, references 2 Russian. [107-2415]

ANTIVIBRATION AND DAMPING CHARACTERISTICS OF SHAFT CONNECTORS BASED ON CENTRIFUGAL COUPLINGS

Vilnius VIBROTEKHNIKA in Russian No 3(27), 1979 pp 43-50 manuscript received 19 Jun 73

YERIN, G. D., KALYAGIN, G. I. and HASLENNIKOV, S. P., Chelyabinsk Polytechnic Institute imeni Lenin's Komsomol

[Abstract] Shaft connectors properly designed on the basis of centrifugal (dynamic) couplings ensure not only a high torsional and radial compliance but also the necessary damping nonlinearly dependent on the operating load and velocity. Such connectors provide effective compensation of axial misalignment between shafts. Here their performance is analyzed theoretically in the simplest case of a 2-machine set, on the basis of the appropriate nonlinear differential equations of motion and the corresponding amplitude-frequency characteristics. The performance of such shaft connectors, various types of couplings, was also studied experimentally. Elimination of the metal-to-metal contact by insertion of a rubber pad has been found to lengthen the life of the coupling and to reduce the noise level, in addition to providing an electrical insulation. Its elasticity characteristics become nonlinear because of the particular linkage kinematics combined with the involvement of inertia forces and friction torques. The results confirm that a centrifugal coupling is an effective device for tuning out resonance and lowering the vibration level in multimachine sets. Figures 5, references 3 Russian, [107-2415]

UDC 62-755:621.375.826

BALANCING THE RUNNERS OF GAS TURBINE ENGINES WITH THE AID OF A LASER BEAM

Vilnius VIBROTEKHNIKA in Russian No 3(27), 1979 pp 13-17 manuscript received 4 Feb 74

IL'YANKOV, A. I. and LEVIT, N. Ye., Order of Lenin Moscow Institute of Aviation imeni S. Ordzhonikidze

[Abstract] Runners of gas turbine engines on elastically deformable or flexible shafts can be expediently balanced with the aid of a low-power continuous-wave laser beam. The latter will measure displacements of otherwise inaccessible parts within any frequency range without recalibration for different runner materials, in any aggressive medium and also at elevated temperatures. The principle of this method is based on the optical Doppler effect. The necessary equipment consists of a laser source ($\lambda = 0.6328 \mu\text{m}$), a moving mirror, a photomultiplier and an optical receiver. An analysis of physical and geometrical relations yields a simple relation between the mean Doppler frequency shift and the maximum shaft

displacement (its vibration amplitude) in the plane of the laser beam, shown here for a runner mounted on compliant bearings with clearance. Interference can be suppressed by moving the laser source farther away from the runner. The measurement error is of the order of half the wavelength. Figures 2, references 7 Russian.
[107-2415]

UDC 536.24.532.517.4

AXIAL RELIEF OF THE ROTOR OF A HERMETICALLY SEALED PUMP

Minsk IZVESTIYA AKADEMII NAUK BSSR: SERIYA FIZIKO-ENERGETICHESKIH NAUK in Russian No 4, Oct-Dec 80 pp 48-52 manuscript received 6 Jun 79

GERASIMENKO, S. S. and NAGULA, P. K., Institute of Nuclear Power Engineering, BSSR Academy of Sciences

[Abstract] The equation of motion of a viscous incompressible fluid is derived in cylindrical coordinates in projection on the radius for a hermetically sealed pump. The pressure distribution in the pump is calculated by the rotation of the central flow nucleus. Leaks due to displacement of the rotor were calculated as a function of the position of the rotor in the grooves. The experimental data deviate by no more than 7 percent from theoretical calculations. Figures 3; references: 8 Russian.
[112-6521]

UDC 534

ANALYTICAL INVESTIGATION OF THE MOTION OF A CONDUCTOR THROUGH A FERRITE CORE SUBJECTED TO VIBRATION

Vilnius VIBROTEKHNIKA in Russian No 6(30), 1979 pp 77-82 manuscript received 19 Dec 77

ASEYNOV, S. A. and GONCHAREVICH, I. F., Astrakhan'

[Abstract] One of the methods of threading ferrite cores using vibration to move the conductor is considered. The law of motion of the conductor is described with respect to development and use of elasto-visco-plastic models. The equations of motion of two conductors are derived for threading through the ferrite core at right angles. The mean velocity of motion is determined by the motion of the conductor along a vibrating member at individual stages of motion. An integral equation is derived to determine the average rate of displacement during a complete cycle of motion of the conductor through the core. Figure 1, references 2 Russian.
[105-6521]

DYNAMIC CHARACTERISTICS OF RADIAL HYDROSTATIC BEARINGS

Moscow MASHINOVEDENIYE in Russian No 1, Jan-Feb 81 pp 111-114

manuscript received 16 Apr 79, after revision 31 Mar 80

KASHCHENEVSKIY, L. Ya., MENDELEVSKIY, Ya. I. and EGLITIS, V. Ya., Vilnius

[Abstract] The basic parameters describing movement of a spindle driven by external loads include static rigidity and the damping coefficient. Dynamic characteristics of hydrostatic support bearings and step bearings have been studied in detail, but there are few studies concerning radial multiple-recess bearings. A method of calculation is illustrated by the example of a radial bearing with n recesses and constant hydraulic resistance to the entry of lubricant. Pressure on the recesses is a function of both spindle displacement and its rate of rotation, since displacement results in an alteration of hydraulic resistances of the output belts. The method differs essentially from others in that the transformation of the initial system of n equations reduces to a single equation in which the sum of certain equations which express pressure forces directly is unknown. Figure 1, references 7 Russian.
[84-8617]

UDC 621.9.077-52

IMPACT LOADS DURING OPERATION OF A PORTAL MANIPULATOR

Moscow STANKI I INSTRUMENT in Russian No 2, Feb 81 pp 13-14

PANOV, A. A.

[Abstract] The rate of design and putting into operation of highly-adjustable automated milling complexes using automated portal manipulators is linked to their geometric and dynamic characteristics. The weight of intermediate products to be installed determines not only the hoisting capacity of the manipulator, but also the configuration of the manipulator and the entire milling complex. Theoretical studies suggest that the system may be seen as a two-mass dynamic model. Values are calculated for the maximum overhang of the portal support beam and the optimum geometric parameters of its cross section. A computer program is used to yield running values of the coordinates of the step motor rotor, output shaft of the hydraulic amplifier, output gear of the speed reducer and automated manipulator carriage. Figure 1, references 3 Russian.
[82-8617]

ASPECTS OF DESIGNING KINEMATIC CIRCUITS FOR AUTOMATED MANIPULATORS

Moscow STANKI I INSTRUMENT in Russian No 2, Feb 81 pp 9-13

KORENDYASEV, A. I., SALAMANDRA, B. L. and TYVES, L. I.

[Abstract] The design of the kinematic circuit largely defines the operating characteristics of a planned automated manipulator, the requirements for its control system and the future engineering indicators of the automated manipulator. Some of the vital problems involved in the design of kinematic circuits are examined: high maneuverability of anthropomorphic handlers, real-time control, rate of motion, accuracy of trajectory, reduction of adjusting power of induction motors, tension of kinematic circuits. A mechanism for compensation for kinematic reciprocity of motion of elements is examined: it is a multiple-link mechanical system in which the drive motor shafts represent the input, and the link hinges represent the outputs. Stereotype motion mechanisms are developed for motion in vertical, horizontal and inclined lines while maintaining constant orientation. Mechanisms are presented for balancing static moments and for induction motors with energy recovery. Figures 7, references 7 Russian. [82-8617]

NAVIGATION AND GUIDANCE SYSTEMS

UDC 62-752.2

VIBRATION PROTECTION OF PLATFORMS FOR TESTING THE SENSITIVE COMPONENTS OF AN INERTIAL NAVIGATION SYSTEM

Vilnius VIBROTEKHNIKA in Russian No 3(27), 1979 pp 19-21 manuscript received 24 May 74

KATINAS, V. Yu., KURLAVICHYUS, A. I. and POTSYUS, Z. Yu., Kaunas Polytechnic Institute imeni A. Sniechkus

[Abstract] The sensitivity of transducers in inertial navigation systems is so high that errors due to platform vibrations during testing of gyros and accelerometers in a laboratory become quite significant. It is thus necessary to suppress platform vibrations in the frequency range below 50 Hz as well as the high-frequency angular vibrations of the earth. The platform carrying a test object is mounted on a stationary support and a movable support, both resting on a bed plate which is suspended on an air cushion in a test pit under the laboratory floor. A corrective servomechanism with feedback from an angular displacement transducer to the movable platform support maintains the platform in a horizontal position during angular vibrations of the earth including a sequence of independent Gaussian random processes. The operation of this stabilizing system is based on a recurrence relation between the mean dispersion of the platform inclination angle and the risk function, put in a form easily handled by a digital computer added to the system. Figures 2, references 3: 2 Russian, 1 Western.

[107-2415]

UDC 629.191.2

NEW ELECTROMECHANICAL METHOD OF INERTIAL CONTROL OF THREE-DIMENSIONAL MOTION OF FLIGHT VEHICLES

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 27, No 3, Mar 81 pp 137-139 manuscript received 20 Jan 80

KORENEVSKIY, D.G., Institute of Mathematics, Ukrainian SSR Academy of Sciences, Kiev

[Abstract] The problem of inertial control of the three-dimensional motion of the center of mass of ballistic and space vehicles was solved by using digital

computers, calculators or a purely electromechanical method. New electromechanical methods of rational solution were developed for inertial control of three-dimensional motion of spacecraft. The ballistic equation of three-dimensional motion of a vehicle is considered that takes into account both lateral perturbations of apparent course and apparent speed. The readings of two apparent acceleration integrators are required to plot the instantaneous value of the ballistic equation in the automatic range control apparatus. Figure 1, references 4 Russian, [113-6521]

UDC 531.383

DYNAMIC STABILITY OF GYROSCOPIC SYSTEMS

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR, SERIYA A: FIZIKO-MATEMATICHESKIYE I TEKHNICHESKIYE NAUKI in Russian No 3, Mar 81 pp 27-29 manuscript received 16 Jun 80

ZBRUTSKIY, A. V., Kiev Polytechnical Institute

[Abstract] The dynamic stability of a gyroscopic system was investigated by averaging at main and combination resonances. A system of differential equations of motion and their coefficients is derived to determine the stability of motion under resonance conditions. Analysis of the coefficients of equations of motion establishes the dynamic stability of the gyroscopic system. The stability of the equilibrium position of the system was dependent on the ratio of parameters characterizing the percentage modulation of periodic coefficients, the value of viscous friction and frequency detuning and the mutual value of the modulation coefficients for each coordinate. References: 6 Russian, [114-6521]

FLUID MECHANICS

UDC 621.125:533.6.001.89:599.47

AERODYNAMIC INVESTIGATION OF FLAT TURBOMACHINE CASCADES WITH ADDITIONAL BLADES IN THE CHANNEL BETWEEN BLADES

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 1, Jan 81 pp 104-106 manuscript received 26 Sep 79

BASHUROV, B. P., Leningrad Order of Lenin Shipbuilding Institute

[Abstract] Flat turbomachine cascades with fixed values of relative pitch, angle of flow exit, relative chord value, different values of relative height and initial flow vorticity were investigated. The experiments were carried out on a closed type installation. The absolute energy losses along the height of the main blade were calculated as a function of absolute height and the averaged relative energy loss coefficient was calculated as a function of relative height. Initial flow vorticity on the end limiting surface results in an increase of secondary flow intensity in the cascade and to an increase of energy losses. Energy losses are approximately 25 percent in the flow vortex. Energy losses remain in the 5 percent range in the mid-part of the channel between blades. Energy losses in the wall zone increase to approximately 10 percent on the opposite limiting surface. Installation of additional blades and the initial flow vorticity show no relationship. Figures 2, references 6 Russian.

[109-6521]

UDC 533.6.013.42

HYDRAULIC IMPACT IN A LAYER OF FLUID ENCLOSED BETWEEN ELASTIC PLATES

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, SERIYA 1: MATEMATIKA, MEKHANIKA in Russian No 2, Mar-Apr 81 pp 82-84 manuscript received 5 Jun 80

KIYKO, I. A. and NEMKOVA, L. N.

[Abstract] Hydraulic impact in a layer of fluid was investigated in elastic walls considered as semi-infinite plates whose edges were hinged. Equations of motion were derived to describe the joint motion of the fluid and plates. The deflection of the plates was calculated by using a series of Laplace transforms. References 3 Russian.

[110-6521]

IMPACT AGAINST A FLOATING CONE

Kiev PRIKLADNAYA MEKhanika in Russian Vol 27, No 3, Mar 81 pp 135-137
manuscript received 23 Oct 78

POPOV, V. V., Institute of Hydromechanics, Ukrainian SSR Academy of Sciences,
Kiev

[Abstract] A circular cone with angle of taper β floats with apex downward on the surface of an ideal weightless incompressible and quiescent liquid. The velocity of the cone directed vertically downward was calculated from the moment of impact. A smooth solution to the system of linear algebraic equations is found by using the variational method of regularization. Figures 3, references 2 Russian. [113-6521]

DIFFRACTION OF SH-WAVES BY A NONCIRCULAR CYLINDRICAL CAVITY

Kiev PRIKLADNAYA MEKhanika in Russian Vol 27, No 3, Mar 81 pp 129-131
manuscript received 27 Mar 80

SHUL'GA, N. A. and KOLODIY, V. I., Institute of Mechanics, Ukrainian SSR Academy of Sciences, Kiev

[Abstract] A method based on representation of the solution to the Helmholtz equation in orthogonal curvilinear coordinates is developed to investigate the diffraction of elastic waves on barriers of noncanonical shape. The diffraction of a plane shear wave on a noncircular cylindrical cavity polarized along its axis is considered. If the cross-section of the cavity is square, the highest stresses are reached near the corner points $\theta = 3\pi/4$ and $\theta = \pi/4$ of the frontal and shadow side of the contour. A triangular cross-section produces highest stresses at $\theta = \pi/3$ and $\theta = (2/3)\pi$ at $\xi = 1/4$ and $-1/4$, respectively. The stresses in an elliptical cavity are highest at $\xi = \pi/2$ at $\xi = 0.4$. Figures 4, references 5: 4 Russian, 1 Western. [113-6521]

THERMOACOUSTIC AUTOOSCILLATIONS IN A GASEOUS VOLUME WITH INTERNAL HEAT SUPPLY SOURCES

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 27, No 3, Mar 81 pp 117-121
manuscript received 23 Jan 80

KIL'CHINSKAYA, G. A. and PROTSENKO, O. P., Institute of Mechanics, Ukrainian SSR Academy of Sciences, Kiev

[Abstract] Longitudinal quasi-harmonic autooscillations were studied in a cylindrical heat-insulated volume of a homogeneous, viscous, heat-conducting, chemically reacting gas. Relationships between the acoustic oscillations and the temperature field generated by the internal energy sources were determined. The laws of conservation of mass and energy, the momentum conservation theorem and the equation of state were used to determine the acoustic content of the oscillations. Slight variations of the amplitude of fluctuations in the velocity of disturbed motion of the acoustic contents caused by the heat supply result in significant variations of the temperature field generated by the internal energy sources. References 10 Russian.
[113-6521]

UDC 621.314.57

CONVERSION OF VIBRATIONAL MOTION TO ROTATION OR TRANSLATION BY MEANS OF UNBALANCED MASSES

Vilnius VIBROTEKHNIKA in Russian No 3(27), 1979 pp 149-155 manuscript received 30 Nov 76

RAGUL'SKIS, K. M. and SLAVENAS, A. Yu., Kaunas Polytechnic Institute imeni A. Sniechkus

[Abstract] Stepless conversion of elliptical vibration to translational motion and of translational vibration to rotational motion is analyzed on the basis of the corresponding differential equations, by approximate methods and with the aid of a computer. In the first case a particle-roller vibrates along two coordinates while a plate is pressed against it by a viscoelastic element with a certain force. Here the presence of viscous friction deserves special consideration. In the second case one rotor with an unbalance is placed on a solid body subject to linear vibrations upon excitation through elastic and dissipative elements. The conditions of existence and of stability of steady modes of motion are established for both cases. Figures 3, references 2 Russian. [107-2415]

UDC 621.314.57

CONVERSION OF VIBRATIONAL-ROTATIONAL MOTION TO PURE ROTATIONAL MOTION BY VIBRATIONS OF BASE

Vilnius VIBROTEKHNIKA in Russian No 3(27), 1979 pp 143-148 manuscript received 30 Nov 76

RAGUL'SKIS, K. M. and SLAVENAS, A. Yu., Kaunas Polytechnic Institute imeni A. Sniechkus

[Abstract] A solid body carrying several rotors with unbalances is mounted through elastic and dissipative elements to a stationary base so as to be free to move in a plane along two rectilinear mutually orthogonal coordinates. The differential equations of motion are derived from the equation for the kinetic

energy of the system and the Lagrange equation of the second kind. An approximate steady-state solution is obtained for the general case of n rotors, from which the conditions of existence and of stability of steady motion are established for $n=2$ rotors, one driving and one driven, whereupon the efficiency of transmission of energy (motion) from one rotor to the other is also determined. In the case of only one rotor there are found to exist two stable and two unstable modes of steady motion. Figures 2, references 2 Russian.
[107-2415]

UDC 628.517

DAMPING THE VIBRATIONS OF A PLANE-PARALLEL SYSTEM IN TRANSLATIONAL MOTION WITH LIMITED EXCITATION

Vilnius VIBROTEKHNIKA in Russian No 3(27), 1979 pp 137-141 manuscript received 5 Nov 76

RAGUL'SKIS, K. M. and ULINSKAYTE, G. B., Kaunas Polytechnic Institute imeni A. Sniechkus

[Abstract] A plane-parallel system with three degrees of freedom and limited excitation is considered in translational motion. The problem of suppressing its vibrations with a dynamic damper is analyzed on the basis of the differential equations of vibrations, in the small-amplitude approximation, for a nonlinear 3-mass system. The system of equations is an autonomous one where time does not appear as an explicit variable and the angular velocity does not have to be stipulated precisely, also the initial moment can be selected arbitrarily. The periodic solution indicates how the damper must be tuned to the system parameters for effectiveness. Figures 1, references 2 Russian.
[107-2415]

UDC 621.822.2

ANGULAR DISPLACEMENT OF A ROTOR IN A VIBROBEARING WITH VARIABLE DRAG TORQUE

Vilnius VIBROTEKHNIKA in Russian No 3(27), 1979 pp 115-121 manuscript received 20 Jan 77

KANAPENAS, R.-M.V. and STATKYAVICHYUS, R. V., Kaunas Polytechnic Institute imeni A. Sniechkus

[Abstract] A rotor in a vibrobearing that contains a vertical plain step bearing rigidly connected to a piezoceramic element is considered and the effect of high-frequency vibrations on the preliminary angular displacement of the rotor in such a bearing is analyzed. Changes in the contact characteristics influence the preliminary angular displacement and, in turn, depend on the rate of change of

the drag torque. Here the Maxwell differential equation of the first kind, which relates the angular displacement to the drag torque in a system with stiffness and relaxation, is solved graphoanalytically. In one case the drag torque is a function of the parameters of normal vibrations, in another case it is a function of two velocities: the constant peripheral velocity of the rotor at the bearing surface and the velocity of given axial rotor vibrations. The results indicate that increasing the parameters of normal high-frequency vibrations in a plain step bearing will decrease the preliminary angular displacement, while axial vibrations of the bearing sleeve will make this displacement discontinuous at each half-period. Figures 5, references 2 Russian.
[107-2415]

UDC 620.1.05:531.24

DETERMINING THE MOMENT OF INERTIA OF BODIES WITHOUT THE USE OF A REFERENCE STANDARD

Vilnius VIBROTEKHNIKA in Russian No 3(27), 1979 pp 86-92 manuscript received 4 Mar 75

LABOKAS, M. B., YONUSHAS, Rem. A. and RAGUL'SKIS, K. M., Kaunas Polytechnic Institute imeni A. Sniechkus

[Abstract] One experimental method of determining the moment of inertia of bodies is based on the pendulum principle, instead of comparison with a reference standard, namely on measurement of the vibration parameters of the body after its excitation with an unbalanced vibrator. Here the validity of this method is established theoretically, by solution of the differential equation of motion for the dynamic model of the system consisting of a crossarm pendulum with a source of a periodic excitation force attached to one of the arms far off center. Figures 2.
[107-2415]

UDC 628.517

VIBRATIONS OF A SYSTEM WITH DYNAMIC DAMPERS UNDER LIMITED EXCITATION

Vilnius VIBROTEKHNIKA in Russian No 3(27), 1979 pp 75-81 manuscript received 10 Feb 75

RAGUL'SKIS, K. M. and ULINSKAYTE, G. S., Kaunas Polytechnic Institute imeni A. Sniechkus

[Abstract] The vibrations of a slider-crank mechanism under limited excitation consist of a fundamental mode and odd harmonics. The problem is to suppress not only the fundamental mode but also at least one harmonic, specifically the

third, with the minimum number of linear dynamic dampers. An analysis based on solving the equations of motion reveals that this minimum number of such dampers, all tuned to corresponding frequencies, is equal to the number of harmonics to be suppressed and that each mode is thus suppressed independently. References 4 Russian.
[107-2415]

UDC 534.833

EFFECTIVENESS ANALYSIS OF THE COMPENSATION METHOD OF ATTENUATING THE ACOUSTIC FIELD OF A LARGE PLATE

Vilnius VIBROTEKHNIKA in Russian No 3(27), 1979 pp 37-41 manuscript received 18 Mar 74

VYALYSHEV, A. I., TARTAKOVSKIY, B. D. and EFRUSI, M. M., Institute of Acoustics, Moscow

[Abstract] An experimental study was made to determine the effectiveness of compensating discrete low-frequency vibration modes of a large plate by exciting the same modes in phase opposition. An acoustic field was produced by exciting a large plate with an array of stiffeners, such as used for rolling stock, by means of a vibrator and a phase shifter fed from a sine-wave sound generator. Four compensating vibrators were coupled each to a separate phase shifter. The signal frequency was selected to match the ratio λ/h of wavelength to stiffener pitch and the latter was varied from 3.5 to 20. The compensation, measured throughout the field, was found to improve correspondingly, after the phase shifters had been optimally tuned with each increase of the ratio λ/h . Maximum compensation was established with reference to a control receiver located at a distance of $10h$ from the plate in opposition to the exciter. Addition of a second control receiver on the other side of the test line improved the compensation further, up to 20 dB with $\lambda/h = 20$. The degree of compensation was also found to be highly sensitive to frequency changes, a $\pm 1\%$ change without retuning of the phase shifters decreased the compensation by 6-10 dB. Figures 6, references 2 Russian.
[107-2415]

UDC 534.833

COMPENSATION OF THE RADIATION FIELD OF FLEXURAL VIBRATIONS INTO A SEMIINFINITE PLATE

Vilnius VIBROTEKHNIKA in Russian No 3(27), 1979 pp 31-35 manuscript received 12 Mar 74

VYALYSHEV, A. I., GAVRILOV, A. M., LYUMASHEVSKIY, G. S., TARTAKOVSKIY, B. D. and CHONI, Yu. I., Institute of Acoustics, Moscow

[Abstract] The problem of compensating the radiation field of flexural vibrations into a semiinfinite plate is analyzed, assuming the radiation field to be produced

by a harmonic generator on the plate boundary. The object is to determine the locations of pairs of compensating sources symmetrically distributed with respect to the generator, and then to calculate the resultant excitation potential distribution. The degree of compensation is measured by the mean-square error of field intensities. Two procedures are shown for optimizing the locations of the compensator pairs in a polar system of coordinates, namely a recurrence procedure for using the maximum energy efficiency as the criterion, and orthogonalization by the Schmidt method for using the minimum mean-square error independently as the criterion. Figures 2, references 2 Russian, [107-2415]

DETERMINING THE FREQUENCIES AND MODES OF FREE VIBRATIONS OF A CLOSED SPHERICAL SHELL

Yerevan IZVESTIYA AKADEMII NAUK ARMJANSKOY SSR: MEKANIKA in Russian No 5, Sep-Oct 80 pp 44-53 manuscript received 11 Dec 79

MALYY, V. I. and BAZILEVSKIY, S. V., State Institute for the Design, Planning, Research and Testing of Steel Structures and Bridges

[Abstract] Analytical solutions of the problem of free vibrations of a closed spherical shell were analyzed and simplified. Asymptotic approximations were derived for the frequencies and modes of vibrations. Equations of motion were derived in Novozhilov form to describe the free vibrations of a spherical shell. One of the frequency parameters is in good agreement with the higher of the frequencies determined by zero-moment theory. Asymptotic expansions of reduced Legendre polynomials were derived with respect to Bessel functions near the poles and with respect to trigonometric functions far from the poles. The first approximation of an asymptotic expansion uniformly applied over the entire sphere was derived for Legendre polynomials by using the procedure of joining asymptotic expansions. These formulas permit accurate calculations of the modes and frequencies of free vibrations of a closed spherical shell. References 12: 8 Russian, 4 Western. [111-6521]

UDC 539.374

BEHAVIOR OF AN ELASTOPLASTIC SHELL OF REVOLUTION UNDER AXISYMMETRICAL DYNAMIC LOADING

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, SERIYA 1: MATEMATIKA, MEKANIKA in Russian No 2, Mar-Apr 81 pp 67-71 manuscript received 26 Jun 79

KISELEV, A. B.

[Abstract] The dynamic behavior of a shell of revolution was investigated under axisymmetrical dynamic loading by the finite difference method in the Lagrangian coordinate system. Fixed and mobile coordinate systems are used to describe

the deformation process. The equations of motion of the shell were calculated in the Timoshenko approximation. The axisymmetrical deformation of the shell loaded from its front end was calculated on a BESM-6 computer. The shell is deformed mainly in the front part in sections nearer to the cylinder than to the nose. Secondary plastic deformations occur in the front part of the shell near the greatest deformations from the direction of the nose. Figures 3, references 4 Russian.
[110-6521]

UDC 539.3

STABILITY OF CYLINDRICAL SHELLS LOADED BY NONAXISYMMETRICAL PRESSURE AND AXIAL COMPRESSION

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 27, No 3, Mar 81 pp 132-135
manuscript received 20 Jan 80

SIMENYUK, N. P. and BOYKO, N. B., Institute of Mechanics, Ukrainian SSR Academy of Sciences, Kiev

[Abstract] The type of boundary-value curves that characterize the stability of cylindrical shells subjected to pressure and axial compression that vary around the circumference was investigated with respect to the nonlinear dependence of the subcritical state on axial force. A thin cylindrical shell was studied with ratio $R/t = 200$ and length ratios of $L/R = 4$ and $L/R = 2$ under uniform external pressure. Axial compression of the shell alone at $L/R = 4$ causes a loss of stability at $m = 30$ and $n = 7$ and at $L/R = 2$ it causes a loss of stability at $m = 16$ and $n = 4$. Figures 3, references 5 Russian.
[113-6521]

UDC 539.3

NONLINEAR DEFORMATION OF A CYLINDRICAL PANEL UNDER AXIAL COMPRESSION

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 27, No 3, Mar 81 pp 81-85
manuscript received 29 Nov 78

ANDREYEV, L. V., ZAVARYKIN, L. G. and OBODAN, N. I., Dnepropetrovsk State University

[Abstract] A cylindrical panel longitudinally compressed by uniform force is considered with respect to linearization of the subcritical state and displacements on the free edge. Nonlinear equations for shallow shells are derived to describe the deformation of the panel. Solutions are given to determine the dependence of critical load on the angle of half-taper of the panel. The subcritical state of longitudinally compressed cylindrical panels with free longitudinal edges has a significant effect on singular points of the solution. Figures 3, references 10: 6 Russian, 1 Polish, 3 Western.
[113-6521]

LOAD-BEARING CAPACITY OF REINFORCED SHELLS OF REVOLUTION

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 27, No 3, Mar 81 pp 55-60
manuscript received 3 Oct 78

DEKHTYAR', A. S., Kiev State Institute of Art

[Abstract] The problem of the upper bound of maximum load for reinforced shells of revolution was considered with respect to the classical limit analysis. Total and local cyclic-symmetrical forms of breakdown were investigated along with axisymmetrical forms. The shell of revolution was reinforced by a regular system of radial and circular ribs. The load-bearing capacity of a reinforced shell is not increased with a further increase of the load-bearing capacity of the ribs after the physical height of the ribs is reached. Figures 3, references 7: 5 Russian, 1 Polish, 1 Western.
[113-6521]

UDC 533.6.013.42

EFFECT OF AN INTERNAL TRANSIENT WAVE ON AN ELASTIC CYLINDRICAL SHELL

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 27, No 3, Mar 81 pp 50-54
manuscript received 22 May 79

CORDIYENKO, V. I., KUBENKO, V. D. and STEPANENKO, M. V., Planning and Design Office of Electrohydraulics, Ukrainian SSR Academy of Sciences, Nikolayev, Institute of Mechanics, Ukrainian SSR Academy of Sciences, Kiev, and Institute of Mining, Siberian Department, USSR Academy of Sciences, Novosibirsk

[Abstract] The method of minimization of numerical variance is based on superposition of the conditions of selecting the grid parameters at which the range of dependence of continuous and discrete equations should coincide or be sufficiently close to each other. The group velocities of high-frequency components of these types of equations must be set equal and the steps on spatial and time coordinates must be designated on the basis of the derived relations. Numerical variance is completely eliminated and the solution is derived with the accuracy of number representation in the digital computer used to solve the problem. A thin infinite elastic cylindrical shell filled with a compressible fluid is considered. The shell is submerged in an infinite volume of fluid characterized by density and sound velocity. A Fourier series is derived for numerical solution of the problem, using the finite difference method. The pressure variation in the cavity in the case of a source with finite radius is an oscillatory process with relatively large period onto which surges related to the reflected wave front are superimposed. Maximum flexure with identical pressure on the incident wave front is primarily dependent on the amplitude of the pulse. The velocity of the shell surface varies so that acceleration of the shell changes sign, resulting in negative pressures on the outer surface of the shell. Figures 5, references 6 Russian.
[113-6521]

PLANE OSCILLATIONS OF A MEDIUM OF ALTERNATING CYLINDRICAL LAYERS FORMING A CYLINDRICAL CAVITY

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR, SERIYA A: FIZIKO-MATEMATICHESKIY-E I TEKHNICHESKIY-E NAUKI in Russian No 3, Mar 81 pp 40-43 manuscript received 26 Jun 80

SHUL'GA, N. A. and VISHTAK, A. P., Institute of Mechanics, Ukrainian SSR Academy of Sciences

[Abstract] Deformation of a semi-bounded regular medium with cylindrical layers was generalized with respect to one-dimensional deformation of a regular laminated semi-bounded medium with cylindrical and spherical interfaces. The mechanical parameters of the medium were calculated by scalar potentials. An infinite system of algebraic equations was derived for each of the layers of the semi-bounded medium. A finite system of algebraic equations was derived to calculate the unknown values of the asymptotic formula. References: 5 Russian. [114-6521]

METHOD OF NUMERICAL SOLUTION OF NONAXISYMMETRICAL NONLINEAR PROBLEMS OF STATICS AND VIBRATIONS OF THIN-WALLED RIBBED CYLINDRICAL SHELLS

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR, SERIYA A: FIZIKO-MATEMATICHESKIY-E I TEKHNICHESKIYE NAUKI in Russian No 3, Mar 81 pp 22-26 manuscript received 10 Jul 80

GAVRILENKO, G. D., Institute of Mechanics, Ukrainian SSR Academy of Sciences

[Abstract] Algorithms were developed for calculating shells of revolution for stability and vibration in a nonlinear axisymmetrical subcritical state. Nonlinear problems were solved with regard to the theory of ribbed cylindrical shells. The shells were calculated for stability by the sequential approximation method. The natural vibrational frequencies of ribbed cylindrical shells were calculated with slight deviations from the equilibrium position. The grid method was shown to be superior to the finite element method with respect to utilizing computer memory capacity. Figures 2, references 8: 7 Russian, 1 Western. [114-6521]

SOME ORIGINAL DEVICES FOR THREE-DIMENSIONAL STABILIZATION OF HIGH-SPEED ROTORS

Vilnius VIBROTEKHNIKA in Russian No 6(30), 1979 pp 33-43 manuscript received 15 Nov 77

KAVOLELIS, A. P. K., Vilnius Institute of Construction Engineers

[Abstract] Simple, highly efficient designs for eliminating disturbing factors are discussed with respect to rotating systems based on gas-tight cavities with two immiscible fluids of different density. A series of equations is derived to explain the working principle of the devices. Only the partial damping system of the devices is considered in mathematical description and analysis of transverse oscillations of a rotating system due to cumbersomeness of the description. Each of the devices contains a frictional damping fluid that can be combined with the dynamic damping. During rotation the dissociating surface of the fluid assumes a distributed form and reacts to periodic disturbances that can be made highly positive. Figures 6; references: 3 Russian.
[105-6521]

UDC 539.622:621.882.7

KINEMATICS OF RADIALLY SUPPORTED BALL BEARING WITH DRY FRICTION

Moscow MASHINOVEDENIYE in Russian No 1, Jan-Feb 81 pp 103-110 manuscript received 19 Sep 78, after revision 10 Jan 80

ZAPPAROV, K. I., Moscow

[Abstract] The kinematics of radially supported ball bearings with liquid lubrication was studied in the past on the basis of elastic-hydrodynamic lubricant theory. The calculation of bearings operating without a lubricant, with inadequate lubricant or with solid lubricant coatings is usually based on Coulomb's law of friction, or dry friction--a simple model of friction processes occurring in high speed ball bearings. Relationships are given for frictional forces and moments arising in oscillation of a ball in dry friction in a closely-fitting groove. The external source of energy is torque applied to the inner ring. Energy dissipation in the bearing results from force and moments of friction. Figures 5, table 1, references 14: 8 Russian, 6 Western.
[84-8617]

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